

3rd Edition



SHOP KINKS

Bulletin No. 90

**TIME SAVERS AND
VALUABLE SUGGESTIONS**

ON

**How to Do a Better Job
for Less Money**

AND

**How a Difficult Job Can
Be Done Easily**

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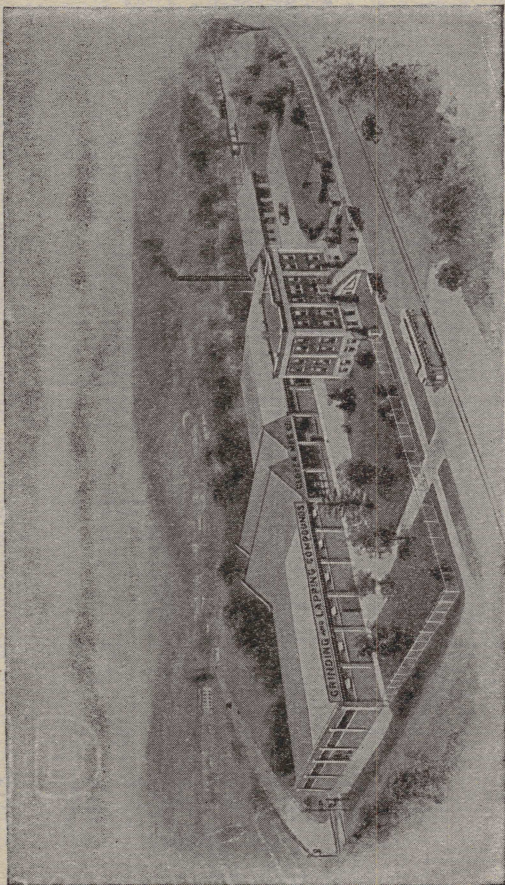
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Desc- BOOK.



DEVOTED EXCLUSIVELY TO THE MANUFACTURE OF CLOVER COMPOUND AND JUST-RITE WATER SOLUBLE COMPOUND
Capacity 10 Million Cans Annually

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Clover Mfg. Co., Norwalk, Conn.

CLOVER SHOP KINKS

3rd Edition

CLOVER Shop Kinks consists of a few suggestions as to how Clover Grinding and Lapping Compound may be employed to advantage in a number of shop operations.

Many short cuts are described in work which is usually considered complicated or difficult, but rendered very simple by the use of Clover Compound.

We give you some strictly technical data; also what may be called some "shoe string methods." But remember always that **the very highest type of mechanical skill** is displayed in being able to devise a way to do a job when you haven't got special tools. Anybody can work if he has the right tools, but it takes a real honest-to-goodness mechanic and genius to do a good job without special tools. Yet such work is done every day in the small repair shop.

The illustrations here given will serve to suggest other operations where Clover Compound can be employed to advantage, and in this connection may we advise that it is our purpose to publish **Clover Shop Kinks** in small editions, at frequent intervals, adding to each edition such new data as we are able to collect in the interim. In other words, we propose to make **Clover Shop Kinks** a sort of **Exchange for Ideas** so that Clover users may benefit by what the other fellow is doing.

We urge you to place your name on our **Bulletin List**, and every new bulletin as it comes out will be mailed to you. Also each new and enlarged issue of **Clover Shop Kinks** will be received by you.

Let us have your suggestions—they may be the means of helping others who in turn may some day, through **Clover Shop Kinks**, help you.

CLOVER MFG. CO.

Norwalk, Conn., U.S.A.

Some General Information on Clover Products

1 What is the difference between **Clover Grinding** and **Clover Lapping Compound**? There is none. The shop man calls an abrasive compound a "Lapping Compound," and yet when he uses it on a valve or a cock, he talks of it as a "Grinding Compound."

Grinding compounds are of two general classes—grease mixed and water mixed—**Clover Compound** is our grease mixed and **Just-Rite** is our water-soluble product.

The water-mixed, valve-grinding compounds are nothing more or less than compounds made with a water-soluble base or binder, instead of a grease base, mixed with a **highly concentrated abrasive content**, so that the cutting qualities shall be greater than the all-purpose grinding and lapping compounds, which are and always have been most used for valve grinding.

Water-mixed compounds are only suitable for valve grinding. They are extremely fast cutting; but for really fine work they cannot, any of them, compare with **Clover Compound**, and with all the effort made during recent years to introduce water-mixed compounds, there is sold today more than 100 cans of grease mixture to every one of the water compounds.

Among the water-mixed compounds, **Just-Rite** stands alone as the fastest and most desirable; and we recommend its use for valve grinding to those who are looking primarily for speed, or who are accustomed to water-mixed compounds.

Clover Packages

2 **Clover Compound** is made in 8 grades of fineness: 2-A (microscopic fine), sold in $\frac{1}{2}$ lb. cans only; 1-A (very fine), A (fine), B (medium fine), C (medium coarse), D (coarse), E (very coarse), and No. 50 (extra coarse).

All but the 2-A grade are sold in **single grade compression cover cans** of $\frac{1}{4}$ lb., $\frac{1}{2}$ lb., 1 lb., 5 lb. sizes.

The Famous Clover Duplex Can is made in two sizes: a 4 oz., which is the standard, and a 2 oz., which is a trial size.

These Duplex Cans contain equal parts of Grade D for roughing, and Grade A for finishing. They are intended for the tool kit, and should always be carried along.

3 **Just-Rite Water Soluble Valve Grinding Compound** is made in two grades—**medium** and **coarse**, and is put up, one grade to the can, in $\frac{1}{4}$ lb. and 1-lb. cans.

4 **Clover Compounds** and **Just-Rite**, in all grades and packages, should be carried in stock by **Hardware Stores, Mill Supply Houses, Automobile Supply Stores and Garages**. If your dealer has not the grade you want, you should not accept a substitute or a "just as good." Write direct to the factory, giving your dealer's name, and they will see that you are supplied at once.

Fitting Machine Parts in General With Clover Compound

We can assert generally that all parts of every mechanism require fitting of some character when they are first put together except in the extremely crude machines where they depend on the looseness of fit to keep them out of trouble. Agricultural machinery as a class is a good example of this latter type of machine.

Fine abrasive powders mixed with oil have been used for this purpose in the past, but machinists are fast being educated to the many important advantages of using a **reliable compound** such as "Clover" for this work, and today there are few important shops where Clover Compound is not used exclusively.

Certain it is that all machine parts that are to work together can be vastly improved by fitting them accurately with Clover Compound, and their life and service greatly prolonged by such fitting. And strange as it may seem, this Clover fitting of parts can be accomplished for but a small percentage of the cost of doing the very same work in any other way. In other words—"Twice as good a job for one-quarter the price."

We are going to mention here and there in this booklet, jobs of fitting, more to give you an idea of the vast field where Clover Compound can serve better than anything else, and if you will use your imagination a little, doubtless you will find many other places where Clover can serve you in your particular work.

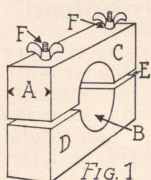
Clover Compound is used in vast quantities by manufacturers of machine tools; gauges, dies, jigs, taps and measuring instruments; locomotive shops; ship yards; makers of gas, gasoline and oil engines; air compressors; ammonia compressors and ice making machinery; by makers of valves, cocks, etc.; by automobile manufacturers generally; by the government in its arsenals, ship yards, air stations, in tool rooms everywhere, for lapping, polishing, surfacing and fitting; and for a hundred other purposes which space alone prevents us from naming.

Lapping Blocks For Exterior Lapping

Remember always, that a lap must be made of softer material than the piece to be lapped. The cutting will then be almost entirely done on the hard piece, and the soft lap will escape with little wear.

Of course this is not taken into consideration when two pieces which must work together are lapped to a running fit. The principle applies, but you have to fit them as you find them.

A SIMPLE FORM OF LAP which will find many and varied uses in the shop is illustrated in Fig. 1.



To make this lap, choose a piece of close grained wood, true up nicely, then bore the hole either the same size or a trifle larger than the piece to be lapped or polished.

Then drill two bolt holes for the bolts, F, F, as shown, using small carriage bolts. The bolts must fit loosely in the holes.

After the bolts have been fitted, remove them and saw the block in two as shown at E, then replace the bolts, being sure to keep the half blocks in their same relative position.

The width of the block A should always be less than the length of the piece to be lapped, so that as the work is revolved, the block may be moved back and forth to avoid scoring or grooving.

Nut-Cracker Lap

A common type of lap which is generally employed for lapping and polishing shafts, arbors and the like is shown in Fig. 2.

This lap is the same as shown in Fig. 1 except that instead of using bolts to squeeze the halves of the lap together, the ends of the blocks are slotted at A and a piece of thin metal A is inserted loosely and pinned to each half at D, D.

The opposite ends of the blocks are carried out as shown and dressed down with a drawknife to form handles, C, C. The pressure on the work is applied by squeezing these handles together.

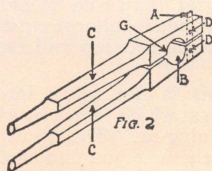
Every shop should have such laps in several sizes, as use will be found for them almost daily for a hundred different purposes.

To make one lapping block serve for several sizes of work, bushings may be used as shown in Fig. 3.

Where it is desired to use such bushings, the holes B, in the blocks, Figs. 1 and 2, should be made large, to allow for a substantial bushing.

The bushings should be turned up on a lathe, the outside diameters to conform to the holes B, and the inside diameter to the size of the work or slightly larger.

A headless nail driven into each half at the bottom of the hole B, projecting inward $\frac{1}{4}$ ", and registering with corresponding holes in the halves of the bushings will serve to prevent the bushing from revolving in the lap.



LEAD LININGS FOR LAPS are much to be recommended, as they hold the Abrasive Compound well and last a long time.

Lead linings may be made by using sheet lead and forming it into the wood lap, making the lead somewhat wider than the wood, then splitting the overhanging portions and folding these projecting pieces up onto the sides of the wood block, then tacking them fast, so that nails cannot come in contact with the work. See Fig. 4.

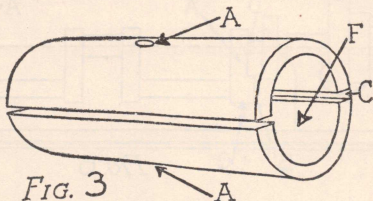


FIG. 3

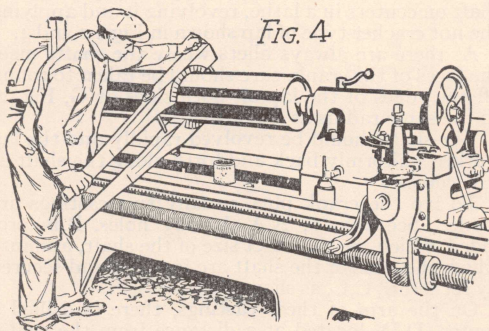


FIG. 4

The Lapping Plate

The lapping plate is one of the right-hand tools in every up-to-date shop and tool room. Its great value can hardly be estimated; operations done on it are numbered in the hundreds.

The best type of plate consists of a close grained cast iron casting, machined true on the surface, with edges machined square to the surface and square to themselves.

The surface of the plate is grooved diagonally in opposite directions, cutting the surface into squares. These grooves are very shallow and are intended to hold the Clover Compound in place on the plate. See Fig. 5.

When Clover Compound has been thoroughly rubbed into these grooves, the plate is known as "Charged." The charged plate should be put where dust and dirt cannot reach it, and is ready at a moment's notice for a job.

Operations where a lapping plate is required are described elsewhere.

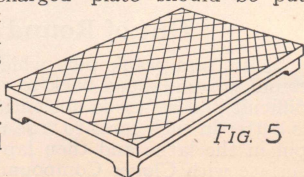
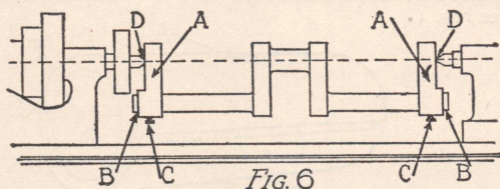


FIG. 5

Lapping a Crank Shaft

The best way to lap or polish a crank shaft, of course, is by using a lathe and special fixtures. But a shaft can be lapped just the same without them, so we shall describe both ways of doing it.

The lapped portion of a crank shaft consists of crank pins and two or more lengths of shaft which are



in line and which are easily lapped by placing the shaft on centers in a lathe, revolving it and applying the nut cracker type of lap shown in Figs. 2 and 4.

As there are always fillets where the shafts meet the faces of the crank, care should be taken to round off the edges of the lap on both sides at G, Fig. 2, to the same radius as the fillets.

The shaft should be revolved rapidly and the lap worked uniformly back and forth along the shaft as it revolves.

To lap the crank pins, usually two castings are made. See Fig. 6, A,A, having holes, B,B, provided, which are the exact size of the shaft, and into which the ends of the shaft are inserted and secured by set screw, C,C, as shown.

On the arm of these castings, there is drilled a center, D,D, located at a distance from the center of the hole, B, equal to the throw of the crank.

By referring to Fig. 6 it will be seen that these castings may be adjusted on the crank shaft so that the centers, D,D, will correspond, and line up with, any of the crank pins; and thus, where there are several cranks on the same shaft, they may each be placed on centers in the lathe and lapped in the same manner as the shaft shown.

The grade Clover Compound suggested for lapping shafts depends always on how much metal is to be removed or how high a finish is required.

You should not hurry a job of this kind, and the Clover Grade A will usually be found about right to do the job. For high finish, the Clover Grade 1-A (very fine) is advised, and for exceptionally close work the 2-A (microscopic fine) grade may be used.

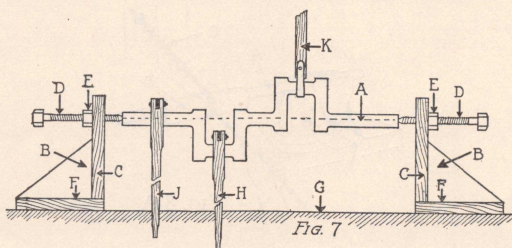
Out of Round Shafts

Shafts and crank pins which have worn out of round *can* be lapped back to round, but the job is difficult and as a rule not entirely satisfactory. It is better in such cases to true up the shaft or crank pin in the lathe and then lap a fine finish on the surface with Clover Compound.

To Lap a Crank Shaft When You Haven't Got a Lathe

By referring to Fig. 7, the shaft A is suspended on centers by the brackets B,B. These brackets are made with hard wood member C,C; through which is screwed a bolt D,D, having a washer and lock nut, E,E, to secure it, and having its end pointed to an angle of 60 degrees. The member C,C, is supported by the base F,F, and the brace B,B; each bracket being screwed to a stiff table or board, G.

To lap a crank pin, apply the nut cracker lap, H, Fig. 7, as described on page 4; smear with Clover



Compound as directed on page 6; then using the lap itself as a connecting rod, rotate the shaft rapidly, at the same time squeeze the lap tightly together and oscillate back and forth along the surface to be lapped.

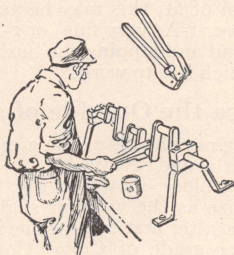


FIG. 7-A

To lap the shaft, apply the nut cracker lap J, Fig. 7, as shown, smear on the Clover Compound as described on page 6. Then with a stick and a piece of leather strap, make a connecting rod as shown at K, Fig. 7, and get someone to rotate the shaft rapidly, while you work the lap back and forth along the shaft.

Enlarging the Hole in a Bushing

Oftentimes it becomes necessary to enlarge slightly the hole in a bushing either to allow it to receive the shaft, or possibly to provide for an easier running fit.

Such jobs are difficult if attempted in the lathe because of the accuracy necessary in chucking the work, and they can only be approximated by the

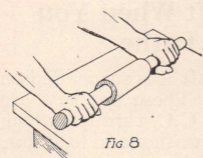


Fig 8

ing, you can place the bushing on the shaft, taking hold of both ends of the shaft as you would a rolling pin, and rolling the bushing back and forth on a board or table, you will quickly lap out the hole to the desired diameter. See Fig. 8. Another method is shown in Fig. 8-A.

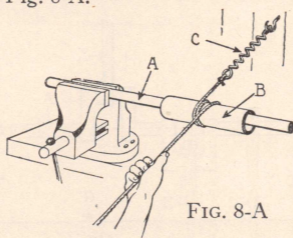


FIG. 8-A

The grade of Clover Compound to be used depends on how much metal you wish to remove. Ordinarily, the Clover A Grade will do the work, but if there is much metal to be removed a coarser grade can be used, such as B, C, or D. If the bushing is almost right, and you desire to give slightly added freedom of fit, this may be accomplished by using the Clover 1-A (very fine) or 2-A (microscopic fine) Compound and lapping the bushing out on the shaft upon which it is to work.

To Reduce the Outside of a Bushing

The bushing may be placed on a mandril, then on centers in a lathe and revolved.

The lapping block shown in Fig. 1 with hole B either same size as the work or slightly larger can then be applied after first coating the inside of the lap with the proper grade of Clover Compound. The width of the block A should be less than the length of the piece to be lapped. Tighten down the wing nuts F,F, slightly, and as the work is being revolved, move the lap back and forth slowly, being sure to distribute its effect evenly on all parts of the work.

The grade of Clover Compound to be used depends, of course, on the size and character of the work, the amount of metal to be removed and the rapidity with which you want to do the work.

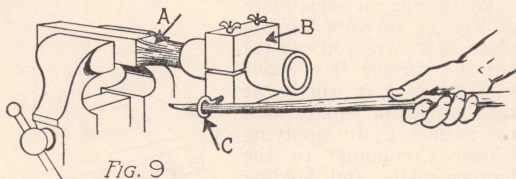
You are always safe, except in very close work, to start with Clover Grade A and work up to a coarser grade if found desirable. The A grade, however, will be found to suit almost all average work, taking a little more or a little less time to do the work as the case may present.

Try for fit often, as over-lapping is the easiest thing to do, and you mustn't be caught napping.

Where You Haven't Got a Lathe or a Mandril

Though you may not have a lathe or a mandril, it is often necessary to do the work just the same.

Whittle a stick of hard wood so that it will drive tight into the bushing, Fig. 9, A. Then clamp the other end of the stick in a vise as shown, so that it projects horizontally.



Apply the lapping block, B, as described above, this time rotating the lap by hand, instead of rotating the work as is the case where you have a lathe.

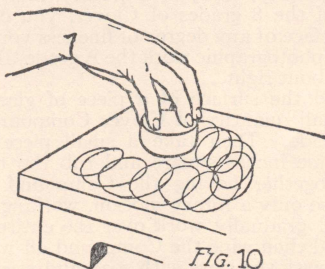
If you have considerable metal to remove, you may insert a large size screw-eye, C, into one end of the lapping block as shown, and with a pointed stick, the tip of which is inserted in this screw-eye, the block may be revolved rapidly with slight effort.

As you rotate the lap, keep it working back and forth slowly along the entire length of the bushing.

Surfacing

By surfacing, we mean the removal of a small quantity of metal from a surface.

As a rule, this must be done uniformly, and here is where your surface plate, Fig. 5, comes in.



The surface plate is true. Therefore, by applying some Clover Compound to it in the proper grade, and rubbing the work over it, you will impart a true surface to the work, and reduce it at the same time.

The pressure you put on the work should be light and uniform all over it, **and you should work in small circles all over the plate.** Never keep rubbing in one spot.

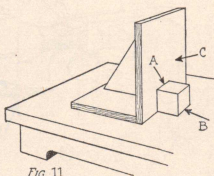
It is usually safe to start with the A Grade Clover Compound (unless the work is extremely fine, in

which case a 1-A (very fine) or 2-A (microscopic fine) grade should be used, and work up to a coarser grade if found desirable.

Take plenty of time. Don't rush the job. Examine and micrometer, or try for fit often. You are very apt to over-lap. Fig. 10.

To Surface Right-Angle Surfaces

By placing an angle plate A, Fig. 11, on your lapping plate as shown, you can (1) lap the surface B of your work so that it will be at right angles or square with the surface C, by applying Clover Compound to the lapping plate and holding the work in close contact with the angle plate while lapping. Or (2) you can lap both the surfaces B and A of the work at the same time, by applying Clover Compound to both the lapping plate and also to the angle plate.



Ground Glass for Photographers

A piece of ground glass which is very finely ground, is a difficult thing to obtain.

Of course you can buy all the ground glass you want but it usually is so coarsely ground that it becomes very difficult to do fine focusing with it. All professionals know this and when they stumble across a piece of finely ground glass they grab at it as a drowning man would at a life preserver.

With Clover Compound you can grind the surface of glass perfectly, easily and quickly, and by using any one of the 8 grades of Clover, you can get a ground surface of any degree of fineness you require.

For fine photographic work the A grade Clover will be found about right.

To grind the surface of a piece of glass, smear with a small quantity of Clover Compound of the desired grade. Then take a small piece of glass two or three inches square and rub the two glass surfaces together having the Compound between them. Use only a rotary motion, working in small circles and gradually work over the entire surface.

Now and then wipe the Compound off with a rag and then wash the glass with soap and warm water, then by holding it up to the light, you can detect any spots which have been missed or which are unevenly ground. A little more Compound and a little more rubbing on such spots will even up the surface so it is perfect.

The Best Brass Polish in the World

Years ago when automobiles were covered with brass that had to be polished, there were more brass polishers at work in a garage than washers.

These men knew their business. They would fight over a dirty piece of cloth which we sold under the trade mark "Klover Kloth," as if it were pure gold.

The fact is, a stout soft rag saturated with Clover Compound in grades A, B or C makes the most perfect brass polishing outfit possible.

Don't throw away your Clover rag when you finish your job. Put it in a tin can or glass jar and cover it up for the next time. Add a little Clover to the rag each time. It will get so black that you will want to throw it away. Lock it up instead or someone will steal it.

The older it gets the better it works.

After cleaning with the Clover rag, go over the surface with a clean rag. You'll get a real surprise.

Rub as much as you like with the clean rag, it won't entirely remove the thin film of oil left on the polished brass. This oil acts as a lacquer, keeping the surface bright twice as long as when polished the ordinary way.

Salt air will not tarnish brass nearly as quickly when cleaned with Clover. **A valuable tip for the yachtsman.**

The use of Clover Compound will not increase your insurance rate.

Do not use on nickel.

Running Together Gearing

No matter how carefully gearing is made and lined up, there is usually some binding or noise due to the teeth not working on their exact pitch diameters, and relief can only be had by the wearing together of the gears, which operation is slow at best, and in the case of hardened gears, often never takes place.

Choosing the proper grade of Clover Compound, depending on the size of tooth and closeness of fit, and applying to the gears while in operation, will result in lapping or grinding the teeth together, making the fit perfect and eliminating the noise.

As most gearing fits closely, we suggest using the Clover Grade A first (or finer for small gears), and going to a coarser grade later if found desirable.

Be sure to apply ample Clover Compound to completely distribute over the teeth in uniform manner, otherwise you will grind unevenly.

Clover Compound will adhere remarkably to the teeth as they revolve and will not melt and run off, but a slow rotation of the gears gives better results than high speed.

Don't carry the operation too far. **Very little grinding will usually do the trick.**

When through, clean off work thoroughly with kerosene or gasoline, using a brush.

Sharpening Edge Tools

A few words on the Subject of Sharpening edged tools may be interesting for, strange as it may seem,

the number of persons who understand how to produce on a tool an edge **that will hold**, is infinitely small compared with those who are using such tools.

In the first place the **angle** which forms the cutting edge proper should be about the same for all edged tools whether the tool be a razor, pocket knife, chisel, axe or cold-chisel. It seems strange, but it is so.

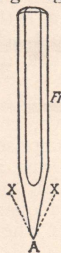


Fig. 14

The next consideration is the **thickness of blade** or weight of metal which you must have back of this edge in order to properly support it *for the work it has to do*.

Let us speak of the angle first.

Please refer to Fig. 12, which shows an enlarged section of an old fashioned razor blade. The wide back of the blade B,C, is made wide so that as the razor is honed or stropped, the blade will touch at the points A,B and A,C, along the lines XX and XX. And you will notice that the angle of the cutting edge formed at A is about 30 degrees.

If we enlarge the cutting edge of this razor blade,

still further, it will look like Fig. 13.

Now let us look at a Cold-Chisel, Fig. 14. You will note that the same angle X.A.X. forms its cutting edge.

With the blade of a properly sharpened pocket knife, Fig. 15, we have the same angle to deal with, also the cutting edge of a chisel and cutter of a plane, has about the same angle.

Please refer to Fig. 16, which is the side view of a whetstone. A knife blade should be held on the stone as shown at A; a chisel or the cutter from a plane, as shown at B; an axe as shown at C, and so on.

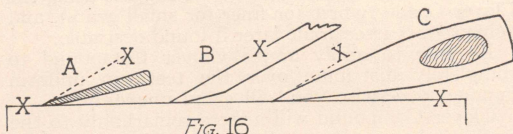


Fig. 16

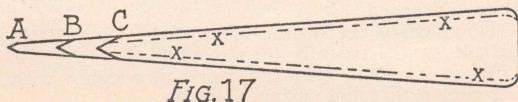
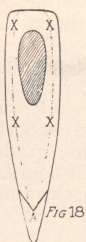


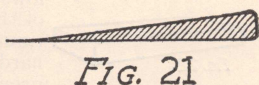
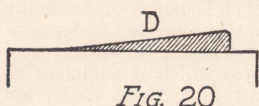
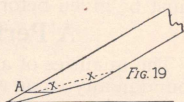
Fig. 17

To determine the thickness of a blade please refer to Fig. 17, which is an enlarged section of a knife blade. You first whet the cutting edge A and the knife cuts well, stays sharp a long time and is



perfectly satisfactory. You then, from time to time, whet your knife, always preserving the same cutting angle and removing some metal until you now have the cutting edge back to B. Your knife is just as *sharp* as it was before, but it takes a little more work to push it through the wood; why? because while the edge is admittedly just as sharp as always, the blade at the point B, has become thicker than it was at A.

You keep on whetting, as the knife is used, until you reach the point C, then you find it takes too much



work to push the blade along, constantly increasing because of its thickness, so now it is time to grind down some of this superfluous metal on a grindstone, or emery wheel, being careful not to draw the temper, to get the blade back to its original shape, so you grind along the dotted lines XX, which are parallel to the original sides of the blade, being careful **not to allow your grindstone to touch the cutting edge**, which should at all times only be whetted on a whetstone.

In the case of an axe, Fig. 18, when the cutting edge has reached a point A and the axe has become too thick, you grind away along the dotted lines XX, then re-whet a cutting edge. And so with a chisel or plane cutter, Fig. 19, when you have whet back to a point A, you then grind along the dotted line X, being careful not to allow the grindstone to touch the cutting edge.

Referring to Fig. 20, the knife blade D is shown lying flat on the whetstone. This is the **wrong** way to sharpen any edge tool as it produces a very fine, thin, feathery edge without sufficient metal back of it to properly support it in its work. See Fig. 21. It is possible sometimes to produce such an edge which will be sharp, but it cannot remain sharp after it is once used.

Lightening Trigger Pull

Marksmen and expert hunters usually like an extremely sensitive trigger; but when a gun comes from the manufacturer, the trigger is adjusted for ordinary every-day use.

The usual way of lightening trigger-pull is by scraping off a little of the metal with a piece of abrasive cloth; but this is not good practice, because it invariably produces rounded edges that are highly undesirable.

Absolutely true, square edges may be maintained

on the trigger parts by lapping down with Grade A Clover Compound, using a flat piece of brass as a lap.

An expert writes us as follows: "I completely fill the action of a Colt, single-action revolver, with 2A (microscopic fine) Clover Compound and work the action a number of times to 'soften' it and smooth the bearing surfaces. I also use the same grade Clover in the bolt action of Krag rifles. Of course, all parts must be removed and a thorough cleaning must be given before gun is used."

A Perfect Whetstone

The qualities of a perfect whetstone are not to be found in any stone which is offered for sale—the best you can buy is an approximation.

The perfect whetstone might be summed up as follows: (1) Trueness or Accuracy of the stone proper under continued service; (2) a degree of hardness which is sufficient to prevent any edged tool from

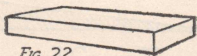


Fig. 22

cutting or scratching stone; (3) pre-determined cutting quality; (4) the ability to obtain several degrees of cutting speed with the same stone.

The whetstones you buy are so soft you can whittle them down with an ordinary knife, and in consequence it is rare indeed to see a stone that has been in service for even a short time not worn hollow or lopsided and, of course, on such a surface, it is impossible to whet down a chisel or the cutter of a plane to a true, straight edge.

You Can Make One Yourself by taking a piece of plate glass from $\frac{1}{2}$ " to $\frac{3}{4}$ " thick, and cutting to the size desired, you can make a whetstone that will be better than anything you can buy.

Any dealer in plate glass will have on hand plenty of suitable scrap, and he will gladly cut you a piece 2" wide by 6" long and grind the edges smooth for 25 cents. See Fig. 22.

To prepare the surface of this glass, simply apply a thin, uniform coating of Clover Compound and work it around on a surface plate for a few moments until the polished surface of the glass disappears and is replaced by a uniform ground glass surface. Or, if you have two pieces of glass which you wish to use as whetstones, simply apply some Clover Compound to one of them, then rub them together, using a circular motion, until both surfaces are uniformly ground. It only takes a few moments to do this, and you can use any of the six grades of Clover Compound for the operation, though we suggest the C or D grades.

Your glass being now prepared, you apply some Clover Compound in whatever grade suits your work, and proceed just the same as you would with an ordinary stone, remembering always to use a *rotary* motion in sharpening a tool, and working the tool all over the surface of the stone—in other words, **don't keep rubbing over the same spot all the time.** If you will follow these two suggestions

carefully, your stone will last for years, and always remain true and in perfect condition.

For ordinary tool sharpening the two grades contained in the Clover 4 oz. Duplex can fill the bill. The coarse grade in this can is D and the fine grade is A. Start with the D grade and work until you get your rough edge, and then finish up to a perfect edge with the A grade.

You can wipe off the glass when through with each operation and apply a different grade of compound, or you can grind off both sides of the glass if you like and make a wood box to hold it. This box relieved in the bottom so that the glass only rests on its edges, allows you to turn the stone over with the compound on it. See Fig. 23.

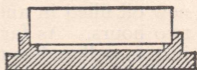


Fig. 23

This Clover Glass Whetstone makes a perfect hone for razors, when used with the 2-A (microscopic fine) Clover Compound.

For Surgeons and Dentists

Fine pointed instruments will not gouge a Clover Glass Whetstone. The 2-A Grade Clover will sharpen the finest edge perfectly.

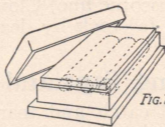


Fig. 23-A

The Clover Glass Whetstone can be sterilized same as your instruments.

Fig. 23-A shows special surgeon's outfit.

Bent Shaft in Gear Case—Repair of an Actual Case

A car was coasting down hill at high speed—intermediate gears in mesh and clutch held out—engine had stopped.

When near the bottom, clutch was allowed to engage abruptly with the natural result—a short kink in one of the gear case shafts which almost prevented the turning of the gears.

Short kinks in a shaft are almost beyond repair—in this case a new shaft would have required a week to obtain.

A first class repair was made as follows: the gear case was thoroughly cleaned of oil. Inside of gear case was lined with paper to catch any Compound that might drop. The rear wheels of car were blocked up. Gears were put in mesh same as when accident occurred.

The Engine was started and run at slowest possible speed; clutch was then slipped in gently.

As gears were revolving Clover Grinding and Lapping Compound was applied to the teeth of the gears with the finger until the entire surface of the teeth was well covered.

Gradually the intermittent roar of the gears, as the bent shaft jammed them together, grew less and finally ceased. The gears had been ground together. While admittedly not as good as new, yet they worked together perfectly.

The Compound was carefully cleaned off with kerosene; paper lining removed; case washed out; new oil filled in and the car was out on the road in two hours. As far as anyone could tell, it worked just as well and as noiselessly as ever.

Put 2-A Clover Compound On Your Razor Strop

With a little tissue paper, rub into the **canvas** side of your strop as much 2-A Grade Clover Compound as it will absorb. Let stand over night, then with a handful of tissue paper, wipe off all the Compound you can.

Use the canvas just as you always have, finishing up on the leather as usual.

With such a strop, honing will be required not more than once every two years, and your razor will always cut perfectly.

Grade 2-A (microscopic fine) Clover Compound is usually not carried in stock by dealers. Write for information.

Relieving Taps and Dies

Often a tap will catch and tear the work. At other times it is found to be a trifle too large, and the tapped hole will be a loose fit for the screw.

A little Clover Compound in Grades 2-A, 1-A or A, according to the size of the work or amount of relief necessary, smeared over the tap uniformly, and then a nut, previously tapped out with the same tap, run up and down on the tap a few times will lap off the tap and produce the desired results.

Likewise a die which does not work right, or which produces an undersize screw, may be lapped by using a screw previously cut by the die in question, as a lap; applying the Clover Compound to it and working it in and out of the die until the desired result is obtained.

Sharpening Clippers

By applying a little 1-A Clover Compound between the movable and stationary blades of a clipper, then working the clipper as if you were using it, at the same time snugging down on the adjusting screw (if found necessary,) you can grind these two blades together and produce new cutting edges which will give results as good as when the clipper was new.

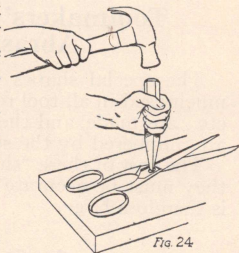
When through grinding, take apart and clean thoroughly with kerosene or gasoline.

We recommend 1-A, or A grade Clover Compound according to size and character of clipper.

Sharpening Scissors

An old pair of scissors that won't cut is considered as worthless about a house as a man who won't work. However, there is hope for the old scissors at least.

If the joint is loose, it should be first tightened by placing the scissors on a piece of iron so that the small end of the screw rests on the iron as shown in Fig. 24. Then with a small cold-chisel applied to the slot in the screw, a slight blow on the chisel will spread the head of the screw downward and tighten the blades together. You can get any degree of tightness you want this way by tapping the chisel lightly and trying between taps.



The blades being now adjusted, to sharpen, apply some Grade A Clover Compound to the business edges of the blades, and begin to work them open and shut rapidly until you have ground a good sharp edge on them.

It may be necessary to give a slight inward bend to each blade before grinding, so that when wide open, the blades come in close contact, and this contact must then progress to the tips of the blades as the scissors are closed. When they are closed, the blades will touch only at their points.

Sharpening Meat Choppers

The four-bladed knife of a rotary meat chopper, such as the well-known "Enterprise" meat chopper, gets dull just the same as any other knife that is used.

This four-bladed knife rotates against the face of a steel plate that is full of holes and through which the material to be cut up is forced by a steel screw.

When the knife fails to cut properly, apply some grade A Clover Grinding Compound to the face of the steel plate and rotate the knife by turning the handle; at the same time tighten up on the wing nut that holds the cutter.

In this way you grind the knife against the plate on which it works and you obtain a perfect job of sharpening. Try it and be convinced.

Cleaning Steel Knives

During the war when it became impossible to obtain Bath-brick from England for cleaning and polishing table knives, Clover Compound came into general use in hotels, restaurants and private homes for this purpose.

A little Clover Compound of grades A, B, C, or D on a rag will polish and clean a steel knife blade in a moment and do a perfect job.

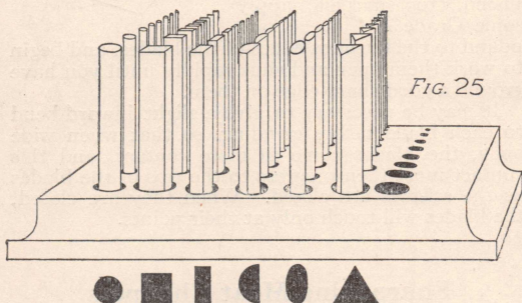
When cleaned wash with soapy warm water and dry.

Don't throw away your Clover rag. The older it gets the better it works. Put it in a can or a fruit jar for safe-keeping. Add a little Clover Compound each time.

Toolmakers' and Die Sinkers' Abrasive Shapes

The special shapes in small abrasive stones are much used in all tool rooms where dies, jigs, gauges, etc., are made, and the uses for these special shapes are numbered by the score.

The cost of these "shape" stones is great, because they must be accurate and the cost of manufacture is therefore large.



The delicacy of these "shapes" is well known, and so brittle are they in fact, that it is rare indeed if one or more of them are not broken on every job.

Being made of a clay, charged with abrasive powder and then baked, they are of necessity soft and wear out or change shape rapidly. The very nature of their construction prevents their being made smaller than in $\frac{1}{4}$ " sections.

By making a set of "shapes" out of mild steel or hard bronze, and using them with Clover Compound, you can accomplish the following heretofore impossible results—(1) produce practical "shapes" as small as 1-16" sections; (2) obtain any variety of shapes desired; (3) by use of the 8 grades of Clover Compound, you can obtain any cutting speed desired; (4) you can use the metal shapes without danger of breaking; (5) the life of a metal shape is ten times that of a stone shape when it works at its best; (6) you can make any length of metal shape you desire.

By referring to Fig. 25, you will see a suggestion for a number of more common sections; also a suggested rack for keeping them in a handy way, always ready for use.

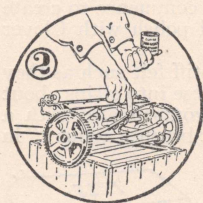
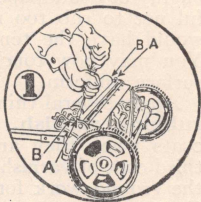
Sharpen Your Lawn Mower with Clover Compound for 5 Cents

With a lawn mower, as with all shears, the blades must come into close contact in order to cut. They must also be sharp.

The best way to sharpen such cutters is to grind them together, and then only are you assured of perfect results.

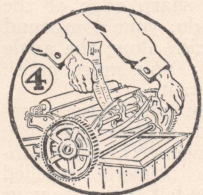
Anyone who can push a mower can sharpen one with Clover Compound in a few minutes by carefully following these directions.

1—Adjust base blade to as even a contact as possible with each rotary blade for entire length. Don't set too tightly together.



2—Apply Clover Compound entire length of each rotary blade with finger tip.

3—Push the mower forward and back rapidly on level surface a dozen times, spinning the blades, and grinding them together sharp.



4—Wipe off compound; blades should cut newspaper like sharp shears; if not, proceed again as above until they do.

We put up a **special package** of Clover Compound, which is sold as "**Clover Lawn Mower Sharpening Compound**" and include full illustrated directions. However, these special cans contain Clover Grade D, and with this grade and the directions here given, you can get perfect results.

Rubbing Down Varnished Woodwork

The old method of preparing and rubbing down varnished surfaces to an "Eggshell finish" such as we see on pianos, furniture, cabinet work, etc., was by employing powdered pumice and water as the polishing agent.

Of course beautiful surfaces were and are thus produced, this we admit, but there is an easier and better way to do the work and without the danger of injury to the wood surface which is always present when water is used.

To produce a fine varnished surface proceed as follows: Scrape the surface free from all tool marks or wavy spots; **this is very important!** then sandpaper thoroughly, finishing with oo paper. Now apply a thin coat of wood filler, and if there is any coloring to be done it should be in this filler coat, which should be mixed with varnish. When thoroughly dry sandpaper this coat smooth, being careful not to rub too much in any one place, which would have the tendency to produce light spots. You may now touch up any defects, making the surface uniform.

Apply several thin coats of the **highest quality rubbing varnish**, sandpapering lightly between coats when they are thoroughly dry. When the third coat of varnish is dry you commence to create the ground work for your final polish with Clover Compound.

Get several pieces of heavy, stiff felt such as they make gun wads out of. Cut these into strips about 4" long x 2" wide. Provide yourself also with a couple of short stiff bristle paint brushes about 1" in diameter.

The third coat of varnish should be thoroughly rubbed down with grade D Clover Compound, which should be smeared uniformly over one of the felt pads and also smeared over the surface to be polished.

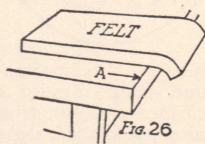


Fig. 26

Caution should be observed in not allowing your polishing felt to overlap any sharp edge of the work as in Fig. 26, for if you do, your compound will cut right through the varnish along the angle edge A and spoil your work. You must polish right up to the edge, but not over it.

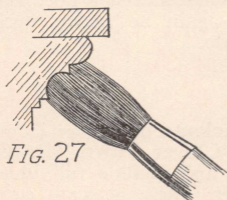


Fig. 27

Where you have complicated angles; carvings; mouldings, etc., which cannot be properly reached with the felt pads, use your stiff brush, first dipping it into the proper grade of Clover Compound, holding it at right angles to the work and polish with it just as you do with the felt. See Fig. 27.

After you are through rubbing down this third coat, clean off all the Compound by using several rags, being sure to remove all Compound from the corners and little recesses.

When the surface is thoroughly cleaned, give another thin coat of varnish and when dry, inspect the surface carefully in reflected light to see how uniform it is. If there are still tiny holes and depressions, you had better rub down again with

D Grade Clover and apply enough coats in this manner, rubbing down each coat, until the surface is free from all imperfections.

Then give another coat of varnish, and this time rub down with A Grade Clover, using a clean new felt pad for this grade.

When thoroughly rubbed down with A Grade, clean thoroughly and then apply the slightest bit of very thin oil, such as "3 in 1", and then polish off all the oil you can with a clean rag.

The surface produced will not yet be a "piano finish," but possibly it will suit your requirements.

If you want to go further, another thin coat of varnish and then rub down with Grade 1-A Clover Compound, and if you have built up your under coats and produced a proper under surface as described, you will now have a real piano finish.

No water having been used, there is no danger of the wood checking or the varnish peeling.

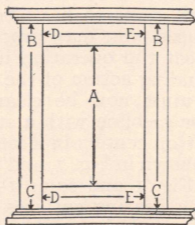


Fig. 28

Where you have stiles about a panel, A, as in Fig. 28, you should rub each stile its full length, but you must not rub over the edge onto a stile going in opposite direction. The vertical stiles in Fig. 28 should be rubbed from B to C, and the horizontal stiles from D to E. The panel should be rubbed vertically or up and down. **Never rub or polish in circles! always in straight lines and always with the grain of the wood.**

To Clean Varnished Surfaces

To clean varnished surfaces, such as desks, tables, chairs, etc., proceed just as if you were rubbing down a new surface, except of course, that the cleaning will be quickly done and little rubbing will be required. For office furniture Clover Grades A or B will work well, while for fine surfaces Grades 1-A or A Clover are recommended.

When clean, wipe off all compound, then with dry rag and few drops of "3 in 1" oil.

Grinding Shafts Into Bearings

You should **rough scrape** your bearing first to remove all high spots, then place your shaft into the bearings just as it is going to work and examine

carefully for alignment, which should be right before you begin to seat your shaft.

Choose a grade of Clover Compound suitable for each particular job. If the work is large and you have *bronze* bearings, you can use a coarser grade of Clover than you can on either a small shaft or on *soft* bearings, such as Babbitt or white metal.

For an ordinary shaft say $1\frac{1}{2}$ " diameter, you can use an A Grade Clover with bronze boxes or 1-A Clover where you have Babbitt boxes.

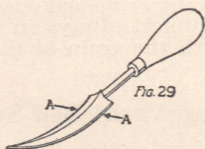
Remove the shaft and coat the bearings uniformly with Clover Compound; coat the shaft at its bearing points with the same Compound, also coat the covers or bearing caps. Then place the shaft back in place; apply the covers and snug down the nuts **finger tight**. Now revolve the shaft a number of times, reversing the direction.

You may now remove the shaft; clean all parts and examine the surfaces carefully. If you seem to have complete contact on all surfaces; that is to say, if the Compound seems to have been grinding all over on all surfaces, you may proceed to the next step; if not, repeat the operation until all surfaces have felt the grinding action of the Compound.

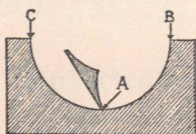
The surfaces must now be cleaned thoroughly, using kerosene or gasoline with a stiff brush.

Place the shaft on centers in a lathe or on improvised centers as shown in Fig. 7, and with the lapping block shown in Fig. 1 and some 1-A Clover Compound, polish the bearing surfaces of the shaft as described elsewhere, **being very careful not to carry the polishing operation too far.**

Next take a bearing scraper shown in Fig. 29 and with a piece of emery cloth dipped in oil and wrapped around a flat stick, dull the cutting edge, A, of the scraper just a little. This is called by shop men a "Smooth scraper."



With this "smooth" scraper you must now burnish out all of the bearings, starting at the bottom of the box A, Fig. 30, and buffing up to the edges, first to B and then to C.



This "smooth" scraper will not actually cut the surface of the bearing, but it will loosen all the feathery metal which has been produced by the grinding, and if there should be any particles of abrasive overlooked, they also will be luffed out. Go over the surface of each bearing carefully in this way; take your time and see that every part is perfectly smooth.

Replace the shaft, but this time apply a very thin **uniform** coat of red lead to the shaft at its bearing points. Replace the bearing caps, snug down finger tight and revolve the shaft back and forth in both directions.

Remove the caps and shaft with great care and examine the points of contact which can be plainly seen in the lead.

You should have, on a properly proportioned bearing, a contact surface of at least 80%. If you have not got it the first time go to it again. Remember, unless you have at least an 80% surface, you will not get satisfactory wear out of your job.

For small shafts or where a very fine bearing surface is desired, use 2-A (microscopic fine) Clover Compound.

Stropping Block

If you have a job, such as cutting up leather, where you must have a very keen edge to work with, and where the edge dulls down quickly, it is found necessary to sharpen the knife a little every few minutes as you are working.

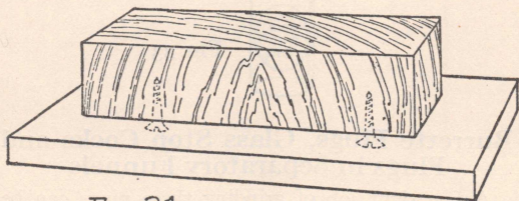


FIG. 31

Take a piece of close grain soft wood and saw out a block about 6" long x 2" wide and about 2" deep measuring with the grain, see Fig. 31. Fasten this as shown, to a piece of 1" board, 8" long x 4" wide, using screws, **and being careful that the end grain of the 6" x 2" piece faces up.**

You may now apply some grade D Clover Compound to the surface of the block as shown, and with a piece of paper you should rub as much Compound into the pores of the wood as it will absorb.

Once in a while you can add a little Clover Compound, but you will be surprised how long one good application will last—it seems to embed itself securely and stays in the pores of the wood indefinitely.

Fitting New Commutator Brushes

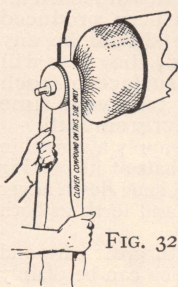


FIG. 32

New Commutator brushes may be fitted to the Commutator by working some grade A or 1-A Clover Compound into one side of a *thin* piece of leather; wrapping the leather around the Commutator; Clover side out; allowing the brushes to press against the leather; then taking hold of both ends of the leather and working it back and forth until the brush assumes the shape of the Commutator.

Do not allow brush to touch Commutator until it has been thoroughly cleaned. See Fig. 32.

In The Chemical Lab

Grinding Glass Stoppers Into Laboratory Bottles

A fine job can be done by using Grade D Clover Compound for seating, then Grade A for finishing, then after cleaning surfaces with some gasoline or benzine, rub surfaces together with water. See Fig. 33.



FIG. 33

Burette Plugs, Glass Stop Cocks and Plugs in Separatory Funnels

A fine tight job of grinding these plugs can be done in a few minutes with Clover Compound.

Proceed as above described. See Fig. 34.

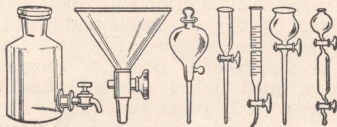


FIG. 34

To Label Glass Lab Bottles

Bottle Labels on glass laboratory bottles can be ground in a few moments on the side of a bottle with Clover Compound, applied with a piece of glass rod. See Fig. 35.

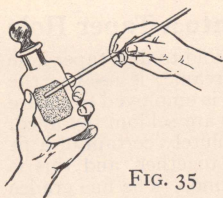


FIG. 35

You can grind a spot any size and shape you desire on which you can write in lead pencil.

You can wash this marking off with water, but it is immune to acids, alkalies and almost all laboratory solvents.

Automobile Starting Motors Which Won't Engage

Usually a small burr or overclose fitting of the gear on the screw drive shaft prevents the gear from "running up" on the shaft and engaging the gear on the fly wheel.

Some I-A Grade Clover Compound applied to the shaft, then working the gear back and forth a few times will free the gear and give the required relief.

Be careful not to carry the lapping too far, and when through clean thoroughly with gasoline or kerosene.

To Correct Worn Ford Timers

Old Ford timers can be made to work like new by making a block of wood to fit the opening snugly, applying some grade A Clover Compound and working the block back and forth, shifting the block $\frac{1}{8}$ turn every few moments. Clean surfaces thoroughly with kerosene before putting back in service.

To Renovate Old Electric Switches

Old Electric Switches can be made to work like new by applying some grade A Clover Compound to the contact surfaces; then, after operating switch a few times, clean thoroughly with kerosene.

The entire switch may then be cleaned up with a little Clover Compound applied with the end of a small stick of wood whittled flat on the end.

Fitting Auto Wheels to the Axle

The manager of a Ford service station writes: "I find Clover Grades D or E excellent for fitting Ford rear hubs on their axles. Not one Ford in ten has tight rear wheels. By taking off wheel, leaving out key, applying Clover Compound on axle, starting engine, throwing in gear and holding wheel on axle for a few minutes, you will have a perfect taper fit between the shaft and the hub. Clover fitted wheels do not become loose." See Fig. 36.

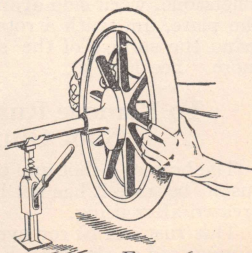


FIG. 36

To Fit a Taper Shaft Into a Taper Hole

To get a taper shaft of any kind to fit a taper hole is difficult and even where a reamer is used in the hole, and a special attachment is employed to secure accuracy of the shaft, yet fits are seldom obtained.

The only way to make absolutely certain of a fit is to lap or grind the pieces together, and this is best done with Clover Compound. The fine grades 1-A and A should be used on all small or accurate work, while coarser grades such as B, C and D can be used on larger or less accurate jobs.

To Make an Anti-Glare Headlight Lens

Most states have laws requiring anti-glare lenses for automobiles—but even where no laws exist, you should have mercy on the poor fellow you meet at night and give him a chance to see the road also.

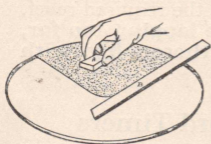


FIG. 37

Fig. 37 shows the method of grinding the surface of the glass lens in your headlights.

Use some Grade D Clover Compound, and with a small piece of glass "A" as a lap, you can quickly transform any part of the lens surface into ground glass.

To make the edges of your work neat, you can hold a straight edge B firmly in place and grind up to it. A rotary motion for grinding is always best.

Re-Surfacing a Worn Whetstone

Whetstones of the ordinary kind are rather soft and become worn quickly.

Nothing is meaner than a "hollow whetstone," as you can't whet a straight edge on a hollow stone, even if you are a genius.

You can re-surface a hollow worn stone by applying some grade E Clover Compound to a surface plate, or to a piece of glass, then place the whetstone, worn side against

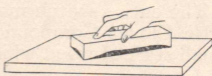


FIG. 38

the plate, and with a rotary motion you will soon grind the surface of the stone true and flat once more. See Fig. 38.

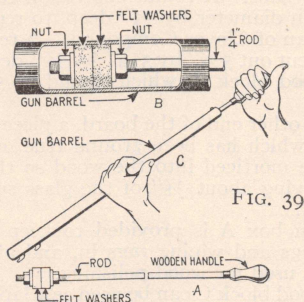
To Remove Rust from Bore of Shot Gun or Rifle

The bore of a shot gun or a rifle often will become rusted because it has not been properly cleaned and greased after using.

This rust can be removed by making up a special lapping rod as shown in Fig. 39-A which consists of a rod, preferably brass, threaded up on one end about 2" and fitted with two nuts and brass washers, between which are clamped several felt washers occupying about one inch in length on the rod.

Some 1-A or 2-A Clover Compound should be applied to the washers, and with the finger, rubbed into the felt until it is saturated with the compound; then all surplus compound should be wiped off from the rod and the washers.

The rod can now be applied to the gun barrel, but you must not insert it in the end of the barrel as shown in Fig. 39-C, but always insert at the breech.



And, by the way, this applies to any cleaning of gun barrels which you have to do—never insert your cleaning rod in the end of the barrel, but always at the breech, because the friction of the rod against the inner edge of the barrel will wear it away ever so little, but just enough to spoil the shooting qualities of your gun. Many a good shot who does not know this can't account for his gun changing and going bad.

Don't use any lapping compound coarser than 1-A Clover, and better yet use the "microscopic" fine grade 2-A Clover.

Clean out with kerosene and examine the barrel every few minutes during the progress of the job, and be very careful not to overdo. When the rust is gone, stop; clean out thoroughly and grease.

The felt washers may be slightly enlarged or reduced in diameter by tightening up more or less on the nuts.

Another tip. Never blow the smoke out of your gun barrel. The moisture of your breath acts on the burned powder in the barrel, and rust starts in almost immediately.

Handy Household Cleaning, Polishing and Sharpening Kit

If you are on friendly terms with the women folks, here's a hint. And if you're not "persona grata," here is a chance to square yourself. Same effect as coming home with a bouquet or a box of candy, only more lasting.

You will find described in this bulletin, cleaning knives and kitchen utensils; polishing brass; cleaning and polishing aluminum ware; cleaning and polishing varnished woodwork.

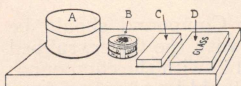


FIG. 40

A complete little household kit can be made by neatly sawing out a hard wood board about eight inches long by six inches wide, and one inch thick, as shown in Fig. 40.

A tin box, A, either square or round, having a cover, can be fastened to one end of the board by screws or nails. A round depression can be cut at B, $2\frac{5}{8}$ " in diameter by $\frac{3}{4}$ " deep, to receive a 4 oz. Duplex can of Clover Compound. A recessed place C can be cut out $5\frac{1}{8}$ " by $3\frac{1}{8}$ " by $\frac{1}{2}$ " deep to receive a soft wood block C, which should be 5" by 3" by 1" thick.

On the other end of the board, a piece of $\frac{1}{2}$ " plate glass D, which has been ground true on the edges, should be morticed into the wood so that it fits in tight, leaving about $\frac{1}{8}$ " of the glass surface above the board.

The tin box A is provided to keep the Clover-coated rags and wiping rags in, and also pieces of felt to be used for wood polishing.

The wood block C can be used as a lap for cleaning knives, flat surfaces, etc., by applying a little Clover Compound and working it over the surface to be cleaned.

The glass whetstone and method of sharpening edge tools are fully described elsewhere in this bulletin.

Aluminum pots and pans are instantly cleaned with a Clover coated rag.

Remember, the older, the dirtier, the more used the Clover polishing rag becomes, the better it works. **Never throw such a rag away.** When you want it to work faster, just add a little Clover.

To Dress Down the Contacts on Resistance Coils and on All Kinds of Brass and Copper Switch Contacts

An interesting suggestion comes to us from a skilled mechanic in Austin, Minn. We quote from his letter as follows:

"Among the motors I have charge of are several a. c. elevator motors which have two rows of resistance contacts, six in a row, mounted on a slate panel. The movable contacts slide over these and it is essential that they are kept in a perfectly smooth and level condition for perfect operation. It was not always possible to obtain new contacts as the old ones become worn or burnt. It was practically impossible to file them and have them all true, so I tried grade "C" Clover Compound with wonderful success, but now I find that by using the Clover Compound found in the duplex cans, Grade "A" and "D", I can do it a little faster.

"I mounted the contacts on a hard wood block in the same position that they were on the panel, I then took an 8" circular steel face plate and welded the shank of an old drill on the back side. By

bolting my contact block to the drill press table, and chucking my face plate in the drill chuck, the drill press and Clover Compound do the work as well as the manufacturers can.

I use the same outfit for dressing down all sizes and shapes of brass and copper switch contacts, and I consider Clover Compound as one of the necessary tools in my tool kit."

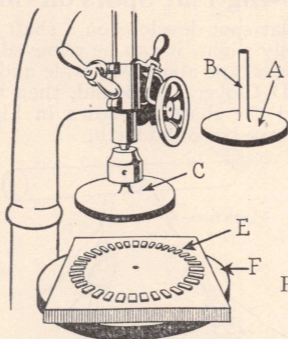


FIG. 41

By referring to Fig. 41, A is the circular steel face plate. B is the shank of an old drill which is welded on the face plate with an oxy-acetylene flame. C shows the face plate chucked in a drill press. F is the board on which the contacts E are mounted. A cast iron face plate will work just as well as one of steel.

To Take Up Wear on Fordson Belt Pulley Gear

When the bevel gears which drive the belt pulley on Fordson tractors become worn, it is desirable to crowd them a little closer together to make them work better.

As there is no adjustment for this, it may be accomplished by applying some grade D Clover Compound to the housing flange and grinding it a little in place. Very little metal needs to be removed to help matters wonderfully.

Once in a while a new outfit comes from the works which has been fitted too loosely, and the same remedy can be applied.

Grinding a Ball Check Valve

A leaky ball check valve can be made tight by using the old ball as a lap; coating it with Clover Compound, Grade A, B or C, according to size, and grinding the seat with a back and forth motion the same as you would grind an automobile engine valve; changing the position of the ball every few moments during the operation.

When the seat is thoroughly ground, use a new ball for the valve.

A Worn Out File Can Be Made to Serve

An old file which is worn out and classed as useless can be made to serve very well by applying to its surface some Clover Compound of the right grade for the class of work to be done, and using it as usual.

An old smooth file with Clover Compound will be found unusually effective for "draw filing."

Removing Flat Spots on Shafts

Where a flat spot develops on a shaft and where the flat is only slight, it can be removed by taking a piece of linen tape about $\frac{3}{4}$ " wide and coating it with grade D Clover Compound, then taking two turns around the shaft as shown in Fig. 42, and working the tape back and forth.

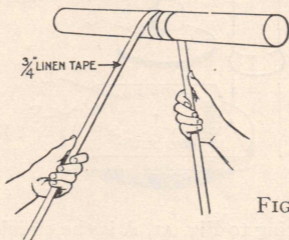


FIG. 42

Care should be taken not to confine your efforts too much to one spot on the shaft, but rather work back and forth a piece to each side of the flat that you are removing.

Emery cloth is often used in this way, but the linen tape, with Clover, does the work better and in half the time.

Another piece of tape with some grade A Clover Compound should be used to polish the job after the flat has been removed with the coarser grade.

Use Clover Compound for the Following

1. Fitting bolts in spring shackles. Grade A.
2. With a piece of plate glass as a surface lap. All grades.
3. Grinding valves. D or E for roughing and A for finishing.
4. Lapping out score marks from cylinders. Grades A, B, C, D.
5. Fitting piston rings. Grades A or I-A.
6. Grinding carburetor float valves. Grades I-A or A.
7. Grinding brass needle valves on steam cars. Grades I-A or A.
8. Grinding throttle valves.
9. Finishing ball races.
10. Removing rust from machined iron or steel.
11. Grinding cocks for steam, gas, oil, water and ammonia.
12. Grinding brass and bronze. Grades I-A and A.
13. Relieving sticky pliers.
14. Sharpening hedge shears and edging shears. Grade D.

Ignition Distributor-Point File

The tungsten steel points on an ignition distributor get so hard that sometimes you simply can't touch them with a file. There are small, thin files made for reseating these points when they are pitted and worn; but those who have used them know how unsatisfactory they are—besides, these files are relatively quite thick, and when you are through filing your points don't make a perfect contact at best.

These points, however, may be *lapped* together, and a perfect job assured, by taking a very thin strip of sheet copper and charging it with Clover Compound, then working it back and forth between the points until they come together as they should.

To make the lap, take a piece of thin copper about $\frac{3}{8}$ " wide and 4" long; smear a good quantity of Grade C or D Clover Compound on a piece of glass or on a flat piece of steel; lay the slip of copper into the Compound, then roll the Compound into the copper slip, using a piece of round bar steel as a roller—or, if you wish, you can use a glass bottle as a roller. Use considerable pressure, so as to force the Compound into the copper; then you get a fine, charged lap.

Such a charged lap will cut down the hardest steel points in short order and do a wonderful job.

Spark Plug Porcelains That Leak

Often spark-plugs will be found to leak, due either to carbon getting between the porcelain and the copper gasket, or due to a rough or imperfect piece of porcelain, which cannot be squeezed down tight enough on the gasket to form a gas-tight joint.

Remove the gasket; apply some Grade D Clover Compound to the seat part of the porcelain; then grind it into the metal body of the plug. When ground true and smooth, clean thoroughly and assemble once more with the gasket in place.

Over-Size Gas-Engine Valve Stem

Sometimes it will be found that you are caught with a new valve that has an oversize valve stem. The proper way, of course, is to turn down or lap down the stem to fit the hole; but this may not always be practical; and in an emergency you can coat the old valve stem with Grade D Clover Compound and use this as a lap to enlarge the hole enough to receive the new oversize stem. This can be done by hand, though an electric drill or drill press will do it quicker.

A Lead Disc Lap

To Sharpen and Polish Knife Blades and Fine Tools

If you attempt to thin down a small knife blade or grind away some metal from a fine, hardened tool, you are more than apt to draw the temper and ruin the work; and re-tempering is practically impossible without special knowledge and apparatus.

Such work can be done with a charged rotary lead lap, with little or no danger, and with assured success.

The rotary lap is nothing more or less than a lead disc mounted on a shaft that has first been charged with Clover Compound.

1. You can cast up a disc by first turning up a wooden disc on your lathe of the size desired, say 3" to 4" diameter by $\frac{3}{4}$ " thick, and using it as a pattern to make up a plaster of Paris mold, then pouring the lead or type metal into the plaster. When cool, find the center of the disc and bore a hole of the right size to fit your polishing arbor. Then bore a $\frac{1}{2}$ " hole through the disc at one side of the center to allow a dog to be used when truing up. The disc can then be mounted on a mandrel and put on centers in your lathe and trued up, after which, smear the trued surface with Grades C or D Clover Compound and revolve at slow speed.

Now take a piece of cold-rolled bar stock, say 10" long, and as the coated lead disc revolves, hold the bar against it with both hands, allowing the bar to revolve in the hands, using all the pressure you can against the disc. This will result in driving the Clover Compound into the lead, and when through, you have a charged lead disc that will be one of the most useful tools in the shop for many operations of fine grinding and polishing.

2. If you have no polishing arbor, you can take a piece of cold-rolled shaft and drill a center in both ends; file flats on opposite sides at one end; make a plaster mold as described above; place the end of the shaft, having the flats, on end in the mold, and pour the lead around it. The shaft, with the disc cast on, can then be put on centers in your lathe and the disc trued up and charged as described. The flats will keep the disc from turning on the shaft.

This outfit can then be mounted in bearings with a pulley or can be held in the lathe chuck.

Relieving the Bolt Action on a New Rifle

The bolt action on a new rifle often works stiff; which is an annoyance and prevents quick action. By lapping in this bolt with a little 2-A (microscopic fine) Clover Compound, it can be made to work perfectly.

Removing Rust from Sad Irons

Apply a thin even coat of Clover Compound, in any grade, to the surface of a smooth, flat board. Then work the iron over the treated surface, using a rotary motion, until perfectly clean; then work back and forth, the same as if you were ironing, in order to get the polishing marks to run lengthwise.

A Scratchy Pen-Point

A pen-point that is scratchy and catches the paper can be made to work perfectly smooth by applying a little 2-A (microscopic fine) Clover Compound to a piece of glass, then working the pen gently in circles over the treated surface. Care should be taken not to carry the operation too far.

Making a Feeler Gauge

A mechanic reports that he had an important job where he required the use of a feeler gauge. When he came to look for his gauge, he could not find it—to get another would require three days.

A piece of watch-spring was found that was .001 too thick, and this was lapped down to desired thickness with some Grade A Clover Compound used between two pieces of scrap plate glass, then wiped clean and polished with some 1-A Clover used between the same glass laps.

Cleaning the Moldboard on a Plow

Plow moldboards must be clean and highly polished to turn the ground over properly and to prevent the dirt sticking. When a moldboard is new, or when it has stood and become rusty after using, it usually takes some time before it can be made to work properly.

By applying some Clover Compound, Grade D, to a rag, and with it polishing the moldboard, a bright, smooth surface that will work perfectly in all soils can be obtained in a few moments.

Fitting Glass Tops on Preserving Jars

The glass tops used on preserving jars are often so irregular that it is impossible for the rubber washer to take up these irregularities and make an air-tight joint.

In such cases, a little Clover Compound can be applied to the glass top and it can then be ground true against its seat on the jar; after which the surfaces are washed clean with soap and hot water, and when the rubber is once more inserted a tight joint will be had.

To Bore Holes in Glass, China and Porcelain

Holes of any size may be bored in glass, chinaware or porcelain by using a cutter made of brass in connection with Clover Compound.

For small holes, turn up a piece of brass bar to the desired size of hole, Fig. 43, No. 1. The end A should be squared up true, and hollowed out on end as shown. For very small holes, Grades A and B Clover are recommended; while for holes from $\frac{1}{4}$ " to $\frac{1}{2}$ ", Grades D or E work better. For larger holes, Grades E or No. 50 are suitable, according to size.

For holes over $\frac{1}{2}$ " the process is too slow when a solid round lap is used, as all of the glass under the lap has to be ground away; so, in order to reduce the work, a disc is cut out of the glass by means of a brass cutter made out of a piece of bar stock, Fig. 43, No. 2. To make this cutter, you first turn

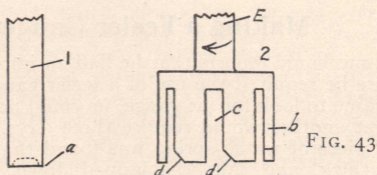


FIG. 43

up the bar to the required outside diameter, reducing the shank E to fit your chuck; then hollow out the end of the bar to form a cup, having the sides B about $\frac{1}{16}$ " thick; then file out several slots (four, six, or eight, according to the diameter of the cutter), as shown at C; then bevel one corner of each cutting blade as shown at D, D, for a direction of rotation as shown by the arrow.

The cutter being ready, it is important to hold the glass so that it cannot possibly slip or shift on the drill-press table.

Insert the cutter in the chuck of the press and gently bring it down close to the glass. Set the press to a slow speed; apply an ample amount of Clover Compound, of the suggested grade, and see that it gets under the cutting surfaces; start the press, then lower down the cutter, very gently at first, until it comes in contact with the glass and has ground for itself a true seat; then more pressure can be applied, but always with great care.

During the operation, keep adding Clover Compound and make sure that it gets to the cutting surfaces. It is well to raise the cutter slightly once in a while as it revolves; this better allows the Compound to work under it. Take your time—don't hurry the job too much.

Where it is necessary to use a hand drill instead of a drill press, the great danger lies in getting the cutter out of line while it is in a partially completed hole, as this will always result in breaking or chipping the glass. The greatest care should be used to keep the alignment of the cutter in the hole perfect.

Cleaning Out and Enlarging the Hole in Carburetor Spray Nozzles, also Nozzles Used in Gas and Kerosene Stoves.

The holes employed in spray nozzles of all kinds are usually very small; and they are apt to close up as they are used, due to the accumulation of either a dirt or carbon deposit. To clean out these tiny holes, without injuring them, is quite difficult; and even when a small drill is at hand, you are apt to spoil the job by its use.

You can lap out small holes with perfect safety by employing a very fine, charged copper wire as a lap; and if it is desired to increase the size of the hole slightly, this also can be done, by lapping, without danger.

Take a piece of fine spring copper wire, place it between two pieces of plate glass or between two flat steel plates with a small quantity of 1-A or 2-A Clover Compound. Roll the copper wire in the Compound between the plates, using considerable pressure, in order to press the Compound into the wire and thus charge it. When the wire begins to lose its cutting power through use, repeat the operation. A wire thus charged can be worked carefully through the hole and will do the job to perfection.

Smoothing and Polishing the Edge of a Piece of Glass

After cutting a piece of glass with a glass-cutter, the edges are sharp and often irregular—they may be smoothed and straightened with some Grade D Clover Compound, using another piece of glass as a lap; or a piece of flat, hard wood can be used as a lap, if found more convenient. The work is quickly done.

Oftentimes a piece of glass is cut a trifle too large to fit, and in such cases it may be quickly brought down to size, without danger of breaking, by the above-described method.

For the Dentist—Polishing Gold and Amalgam Fillings

The dentist needs a cutting material for polishing hard fillings that will cut fast, give a high polish, and that will stay on the surfaces during the operation.

Clover Compound, in Grades 2-A and 1-A, is now being used by countless dentists for this and other work in their laboratories.

Clover Compound Should Be On Sale

In Every Hardware Store
and Mill Supply House; by
Every Automotive Equip-
ment Jobber or Dealer and
in the Garage.

*If your dealer hasn't got
exactly what you want, send
his name and your order to
the manufacturers and your
needs will be filled at once.*



Clover Compound is sold in
single grade packages of $\frac{1}{4}$ lb.,
 $\frac{1}{2}$ lb., 1 lb., and 5 lbs. and made
in 8 grades: 2-A (microscopic fine);
1-A (very fine); A (fine); B, C, D,
E (coarse) and #50 (extra coarse)



For the Tool Kit and for Valve
Grinding, Clover is put up in the fa-
mous 4 oz. and 2 oz. Duplex Cans,
each can containing equal parts D
for roughing and A for finishing.

Other Clover Instructional Pub- lications

Bulletin No. 75—The Last Word on Valve Grinding.

Bulletin No. 80—How to True Out-of-Round Cylinders. How to Fit a Set of Rings to a Piston. How to Lap in Rings to the Cylinder. How to Remove Score Marks from Cylinder Walls.

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